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Use of evidence NDVI, NDBI, NDWI, MSAVI to reveal the uses of agricultural land in karma district using modern technologies

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Abstract---The study of agricultural land uses in karma district relied on a range of ideas using modern geographical techniques to build a model of simulation of spatial distribution of land uses, which used sensor data after key sources in detections uses of land cover through reliance on satellite data (Land Sat-8) and sensor (OLI) For 2020, to achieve the study's objective, normalized Difference Vegetation Index (NDVI), Normalized Difference Built Up Index (NDBI), Normalized Difference Up Index (NDBI), Normalized Difference Water Index (NDWI) and Ms AVI) Modified Soil Adjusted Vegetation Index.

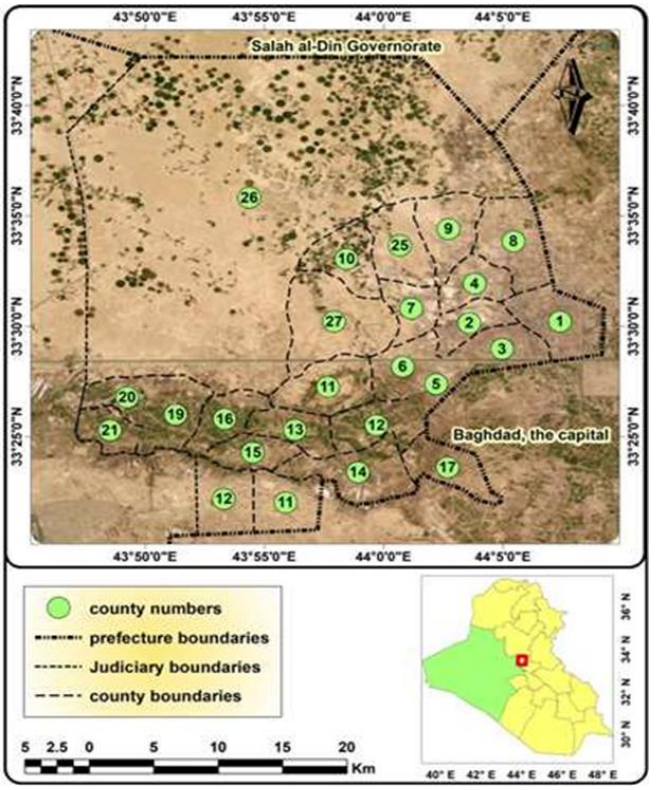
Keywords---digital processing, bands, space visuals, evidence NDVI, NDBI, NDWI, MSAVI.

Introduction

The use of digital evidence is one of the best methods of classification and detection of forms of agricultural land uses, and this digital evidence is one of the most important improvements applied to space visuals and the resulting division and collection of digital numbers values of one of the spectral beams on the corresponding values in other spectral packages, and the importance of this lies in the transformation of spectral characteristics of visual manifestations, as these visuals show the difference in the spectral reflective curve of the two packages concerned regardless of the reflective values absorbed by spectral beams. It is also a sign of the differences that cannot be observed on the colored visual.

Geography of the study area

The study included the spatial space occupied by karma district, which is administratively affiliated with Anbar province, which is located in the northeastern part of Anbar province and is linked to important geographical boundaries with J.Y. From the east, Abu Ghraib district, to the north and northwest, Taji district, Samarra and Saqlawiya district, and to the south and southwest fallujah district and Al-Amiriya district, so its location can be determined as evidenced by a map (1).The study area is 2,3,103 km, equivalent to (461339) dunums, and its population is estimated at (14,3229,220). This indicates the secret development of the population in the Karma district.



Map 1. Represents the visual location of karma district from Iraq and Anbar province

Source:

- Republic of Iraq, Ministry of Water Resources, Directorate of Public Space, Iraq Administrative Map, 2010, scale (1:1000,000).
- Republic of Iraq, Ministry of Planning, Anbar Provincial Map, Administrative, 2019, Scale (1:500,000).

In this research, landsat-8 sensor satellite data captured on 3 March 2020, with a characteristic accuracy of 15 × 15 m. Part of the original visual (OLI), obtained from the USGS/Earth Explorer website, was used. Looks at shape (1). Using

ERDAS 2015, the shape, defined by astronomical coordinates between the two latitudes (N"30, 33-N" 45, 33) looks north and between two length lines ("E 45.43-"E 0,44) eastward. Seen figure (1).

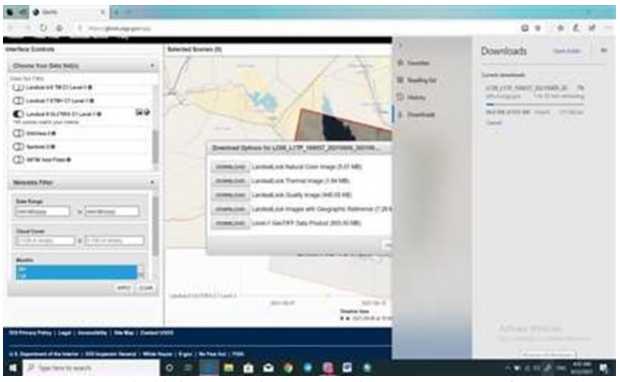


Figure 1. Carry visible study area from USGS/Earth Explorer
Source: USGS/Earth Explorer

Digital processing of space visuals

Digital images are the basis for research and geographical studies, and for the purpose of obtaining the required explanations through visuals that must be characterized by high accuracy and clarity, satellite and satellite visuals are affected by engineering distortion and for the purpose of correcting this distortion that you suffer after multiple visual corrections, the most important of which is image rectification and various improvements (Enhancement).

Primary treatment

The correction process is a set of actions aimed at correcting distorted and degraded visualization to create representation of the real scene by correcting geometric and radium distortions and removing distortions from the visual or maps by studying their properties and the work of registration for them and matching them with reality(6). As follows:-

Bands Composition

The colorful display of space visuals on the computer screen is important for active remote sensing processors, bands Composition is the term used in this area to refer to the representation of space visuals at different spectral levels more accurately and clearly than in levels Spectral gray(7), i.e. digital images can be converted into analog images With continuous display, it is usually pre-tuned to display 8 Bit/Pixel gray scale, 8 Bit/Pixel for colored gradient(5). See Figure (2).

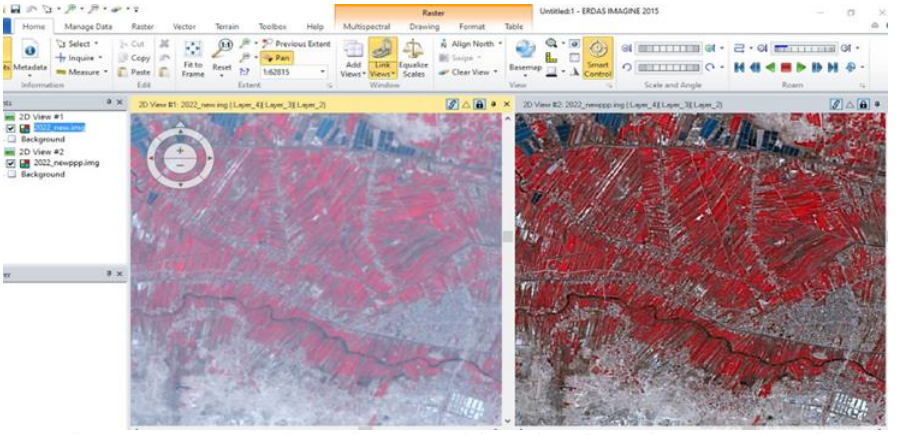


Figure 2. Integration of spectral bands of study area visuals
Source: Using ERDAS IMAGINE 2014 based on visible moon LandSat 8 sensor (OLI)

Single bands appear on the gray scale because they have one spectral field by digital value per image unit, while the built-in RGB band visible (red, green green, blow blue) appears on the computer screen in a color form, as it contains multiple multispectral spectra The resulting colors of the space visual are based on the spectral composition specified by the user by incorporating three bands into the RGB system, each package that goes to one of the three colors specified in in-system processing. When spectral bands containing the wavelengths of the visible spectrum correspond to RGB processes, they result in a true color space visible, but if bands with wavelengths beyond the visible spectrum, such as infrared, are deposited, they are produced in false color, and the latter is useful in amplifying visual perception in distinguishing features over space visualization.

Subsequent processors

After making corrections and creating the space visual, necessary improvements, as well as transformations, are required to reflect the most accurate information carried by the space video used, in order to reach the best scenes that enable the researcher to interpret when classifying the uses of the agricultural earth in the vine district.

Image Enhancement Visual Improvement

Improving visuals aims at visual interpretation of visuals by increasing the distinction between the features of the scene in the visual, as the digital advantage is that it allows the processing of the values of the[(2)] pixel DN digital image unit, in the visual body and means a number of actions that take place on the visual and which deal greatly with spatial frequency spatial frequency in order to obtain a new visual and the clearest scene for the purpose of easy interpretation and access to information and data through spatial improvement and spatial integration of the visuals and prepares Identifying ground adjustment points in the visual is a basic process for producing integrated visual maps[(7)] The

special visual (3) is observed in the study area, after which the spectrally improved visual was classified, which showed that high reflexive areas represented a dense vegetation cover, and vice versa to other areas.

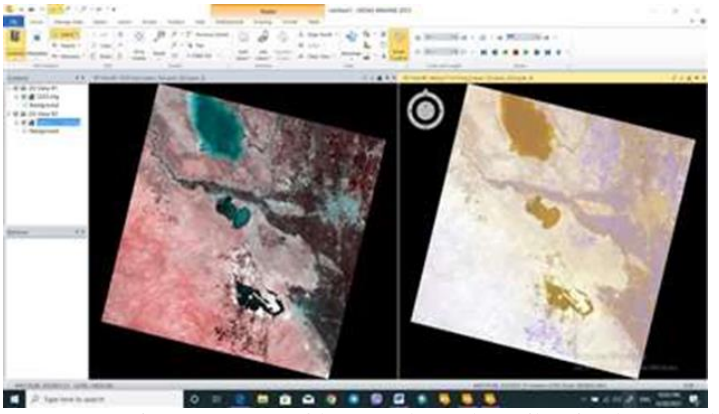


Figure 3. Represents the process of improving visuality by increasing spectral reflectivity
Source: Using ERDAS IMAGINE 2014 based on visible moon Landsat 8 sensor (OLI)

Spatial optimization

It is a process of changing or modifying the values of digital visualization (Pixel), which varies depending on the interaction of materials with electromagnetic energy, and this type of improvement deals with spatial frequencies (digital number change) which represents changes in the intensity of lighting in the distance unit of each particular part of the image, as digital image data may contain part of high Spatial Filtering data and another part on filtering low spatial frequency data. The use of high spatial resolution spectral bands is one of the most important spatial improvements aimed at increasing the accuracy of visual spatial excellence, thereby increasing the possibility of visual interpretation of the visual. See Figure (4).

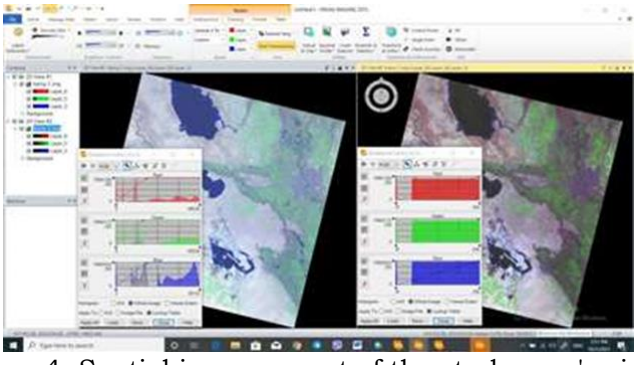


Figure 4. Spatial improvement of the study area's visual
Source: Using ERDAS IMAGINE 2014 based on visible moon Landsat 8 sensor (OLI)

This indicates rough areas where brightness or chromatic gradient is sharp and sudden, while smooth areas that are limited in brightness or color contrast, 30m high spatial feature spectral channels observed (4), through which space images were processed using Arc Gis with band 8-Panchromatic range, were combined. The central wavelength (0.68-0.50) wavelength and resolution Spatial 15 spatial accuracy are characterized by the selection of spectral beams (2.3,4,5,6,7), which have high variation coefficients and then integrate them with band 8-Panchromatic as being more accurate and capable of distinguishing objects from each other and types of agricultural uses(1).

Cutting

The cutting of the study area was performed from satellite space visuals (LANDSAT-8) resulting from the mosaic process and based on the Area of Interest Aoi file, which is intended to cut areas beyond the boundaries of the study area (surrounding them) and look at figure (5). Visual data and the ease of conducting the necessary digital processing processes in the study, that keeping the visual Spectral reflective values that will enter into the calculation of the level of reflection, minimum and upper, standard deviation and medium:

- Time and effort problems when performing different digital processes.
- Large-volume problems with used visuals that delay processing on the computer when processing visuals.
- Problems when calculating spaces and converting them to Polyons after the digital and visual classification process.

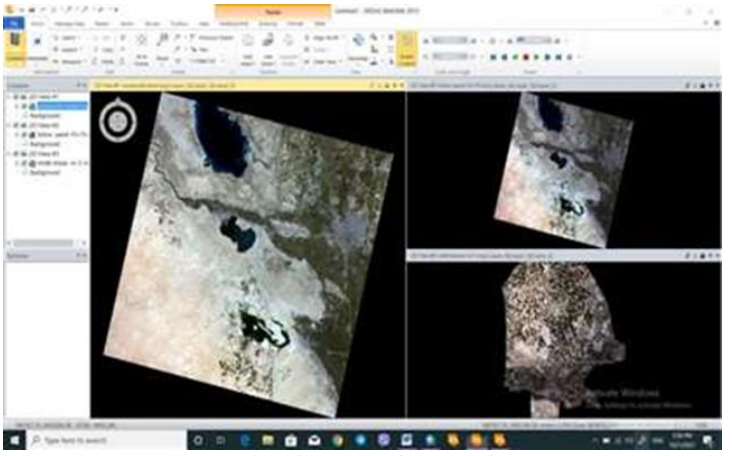


Figure 5. Clipping for study area
Source: Using ERDAS IMAGINE 2014 based on visible moon LandSat 8 sensor (OLI)

NDVI Natural Vegetative Differences Guide

It is a good guide to the state of green cover detection of barren soils, as a measure of spectral reflective variations of life components, and the NDVI guide has the ability to reduce external noise factors, such as topographic effects and changes in the angle of the sun, and can be used to calculate the coefficients of

erosion and evaporation[5]. Using the NDVI guide , we get a cartographic model that shows the density of vegetation in the vine district through gray gradient or color mixing gradient. When sunlight falls on terrestrial bodies, certain wavelengths of this spectrum are absorbed and reflect other wavelengths. According to the following equation:

✠ NDVI = (NAR 5 – RED 4) / (NAR 5 + RED 4)

We enter the equation for the NDVI Natural Green Variation Guide, so we choose where to store the new guide layer, we choose **Flot** as shown in Figure (6), and then choose **OK**.

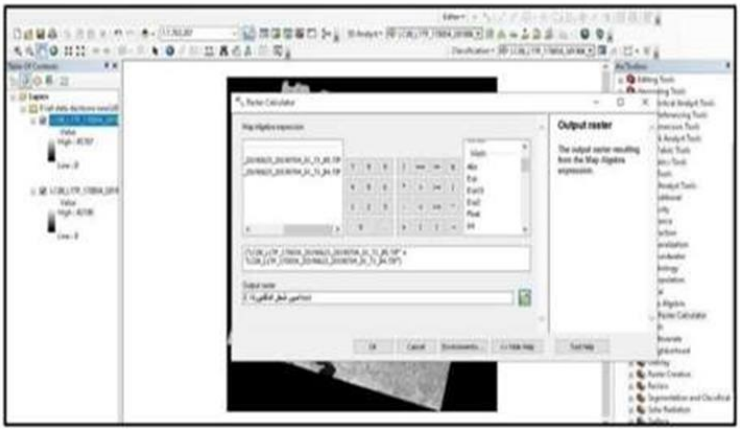
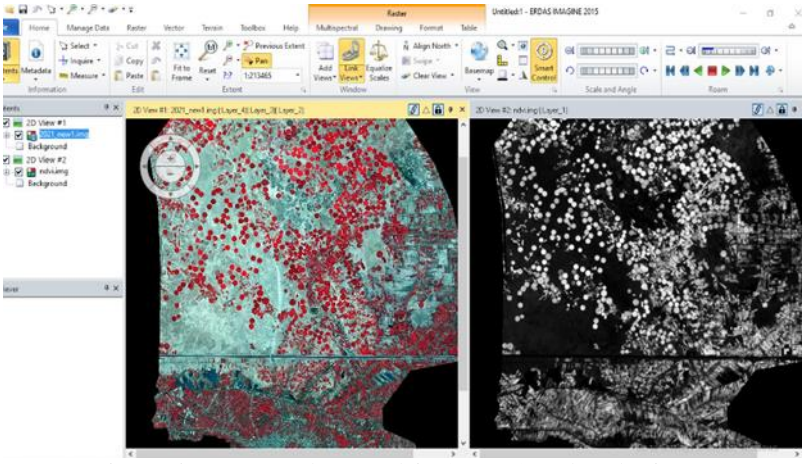


Figure 6. Apply the NDVI manual equation
Source: USING ARC GIS 10.8,1

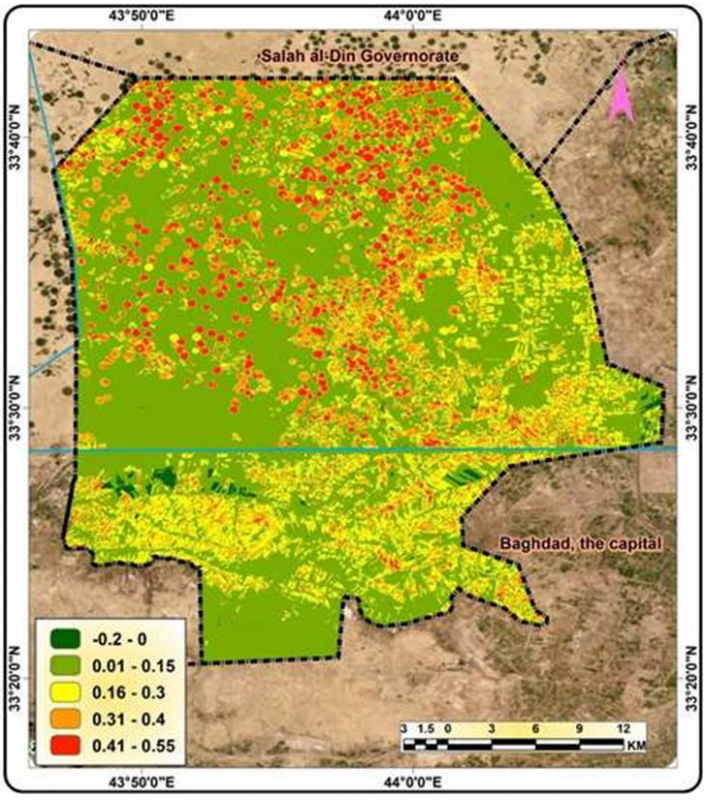


Shape 7. Vegetation Guide (NDVI) using indexes
Source: UsingERDAS IMAGINE 2014 based on visible moon LandSat 8 sensor (OLI)

The NDVI guide was applied to the space visual data of the vine spend taken from **land** SAT-8 satellite footage with oli sensor, which showed the results of the NDVI natural green lab manual for green earth excellence, i.e. obtained visible in

black and white and showing dense vegetation with high reflectivity and bright white color, and in areas with low density vegetation shows less reflectiveness and less white seen figure (7) and map (2). By calling the channels for the digital evidence of the NDVI manual, an indicator is extracted and the equation is applied through the following:

Arc tool pox – Spatial Analyst Tools – Map Algebra – Raster Calculator



Map 2. Vegetation Guide (NDVI) using indexes
Source: ARC Map and Land Sat 8 OLI 2020

Table 1
Vegetation Guide (NDVI) using indexes

to	items	Items	Area (km2)	Percentage (%)
1	Plant-free	-0.2 - 0	9.0	0.9
2	Degraded vegetation cover	0.01 - 0.15	597.0	57.5
3	Low density	0.16 - 0.3	171.1	16.5
4	Average density	0.31 - 0.4	136.3	13.1
5	High density	0.41 - 0.55	124.6	12.0
	Total		1038	100

Source: ARC Map and Land Sat 8 OLI 2020

The value of the guide is thus between (1 and 1), as the positive value indicates that the cell has a plant cover and the greater the positive value indicates plant greenness and density, and the closer the value of the guide to the negative value indicates non-green surface features. Map (2) and table (1) of color swing aim to determine the presence of vegetation and know its extension and area in the karma district, and used the method of surveying gradient, the means of spaces, the style of colors and shades graded based on the natural vegetative variation index (NDVI) in the number of this map, and the study area was divided into five categories, so it was

- **The first category (plant-free**): the category between (-0.2-0) with an area of 9.0 km^2, thus accounting for 0.9% of the total area of the study area, distributed in the northern parts of the western province of Al-Muhaysin, salt and ugly, and officer Ali Suleiman. These are the areas that represent barren soils, and the spaces that divide.
- **Category II (degraded** vegetation **cover**): the category between (0.01 - 0.15) with an area of 597.0 km2 and a rate of 57.5% and ranks first in terms of its large size, accounting for more than half of the area of study and distributed differently to all provinces of the study area.
- **Category III (low density**): category (0.16-0.3), which ranked second in terms of area of 171.1 km2 and 16.5% of the total area of the study area.
- **Category IV (average density**): between (0.31 - 0.4) with an area of 136.3km2, thus accounting for a ratio (13). 1% of the total area of the study area, distributed
- in the northern parts of the study area, which is the plateau part of karma island province.
- **Category 5 (high density):** category (0.41-0.55), area of 124.6 km2 and 12.0% of the total area of the study area.

Index Normalized Difference Water Guide (NDWI)

This guide represents river water and water bodies such as lakes, ponds and streams, and includes the surface water index equation, the difference between the green visible spectral range and the short wavelength (SWIR) divided by the sum of these two bands, and the following equation used for OLI shows figure (8).

$$\boldsymbol{NDWI} = \frac{Green\ 3 - SWIR\ 5}{Green\ 3 + SWIR\ 5}$$

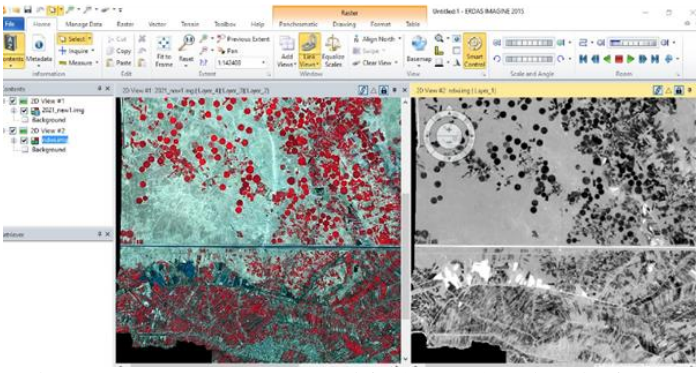
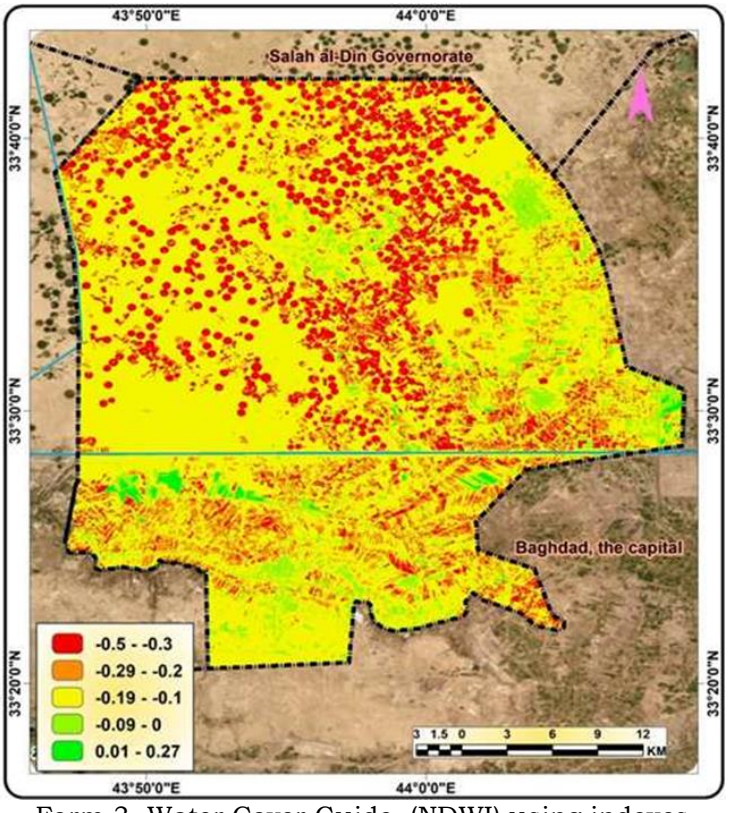


Figure 8. Water Cover Guide (NDWI) using indexes
Source: UsingERDAS IMAGINE 2014 based on visible moon LandSat 8 sensor (OLI)



Form 3. Water Cover Guide (NDWI) using indexes
Source: ARC Map and Land Sat 8 OLI 2020

NDWI guide values range from (0-1) as positive values indicate that they are water surfaces while values below or equal to zero are water cover-free areas and positive value heights indicate high depths, with the NDWI guide applied for black and white esophagus and colored visuals in order to more accurately identify surface water areas seen in figure (8), and map (3) Table (2).

Table 2
Water Cover Guide (NDWI) using indexes

to	Items	Area (km2)	Percentage (%)
1	-0.5 - -0.3	337	32.5
2	-0.29 - -0.2	382	36.8
3	-0.19 - -0.1	171	16.5
4	-0.09 - 0	138	13.3
5	0.01 - 0.27	9	0.9
Total		1038	100

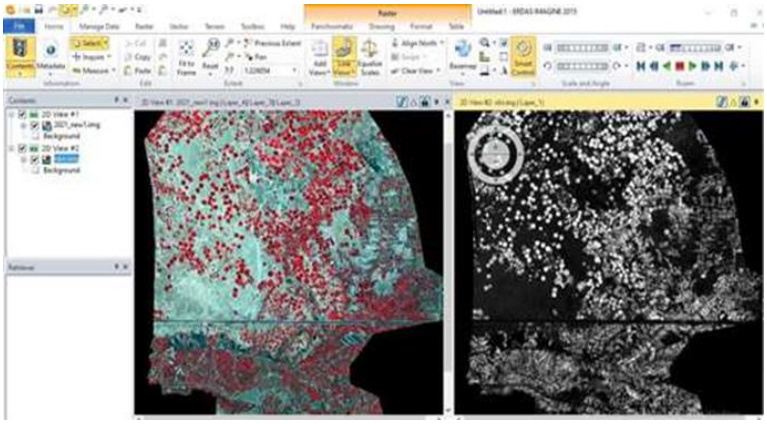
Source: ARC Map and Land Sat 8 OLI 2020

The spectral reflection of water is high in the range of the green wavelength with spectral reflection (0.60-0.52) and these wavelengths are visible within the category range (0.01 - 0.27) which covers an area of 9km^2 and0.9% of the total area of the study area, and is distributed in parts of the flood plain where the surface water systems available and appear in white in the form (in white form) 8), dark violet on model (3) and table data (2). Very few appear in the nearby infrared wavelength with spectral reflectivity (0.90-0.76) and these wavelengths appearclearly within the first four classes, which have an area of 1,029km^2 and 91. 0% of the total area of the study area, distributed in parts of the plateau areas that depend on groundwater (well water) which appears in the gradient of dark brown on model (3) and table (2), and by the gradient of black to gray in form (8).

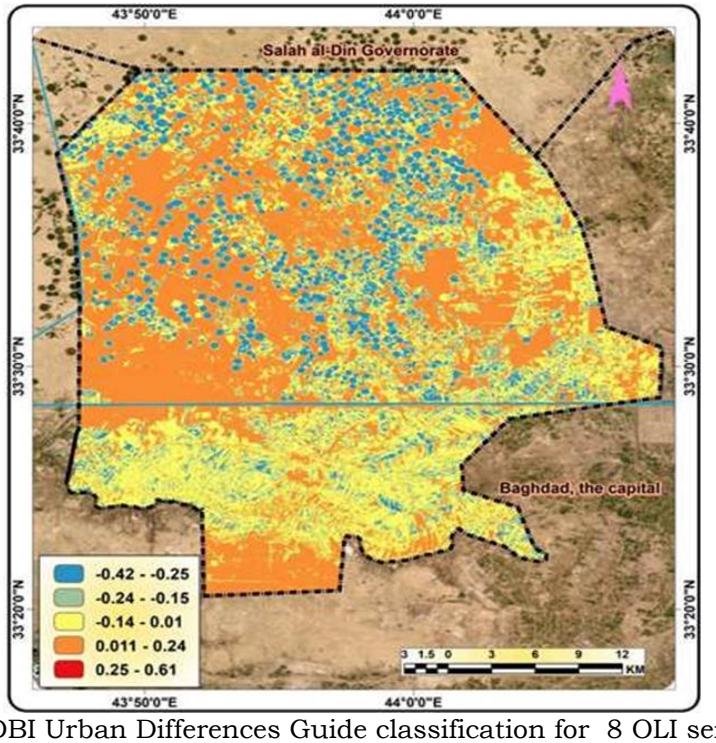
NDBI Urban Differences Guide

The NDBI guide is an important and significant part of the land cover, it is necessary to monitor the changes that occur to the built areas and their overtaking on agricultural land, where the NDBI guide is used in the study of various human sectors including urbanization, manufacturing and other changes in constructed areas, and is widely used in the management of various sectors, as well as taking into account the spectral characteristic of urban areas, and this guide can be obtained through the formulation of the following equation:

$$\mathbf{NDBI = (MIR - NIR) / (MIR + NIR)}$$



Form 9. NDBI Urban Differences Guide classification for 8 OLI sensor visual
Source: ERDAS IMAGINE VER 2015



Model 4. NDBI Urban Differences Guide classification for 8 OLI sensor visual
Source: ARC Map and Land Sat 8 OLI 2020

The NDBI value of the NDBI guide is between 1.-1, the development of the NDBI guide depends on the distinct spectral response of built-up areas with a high reflex in intermediate infrared wavelength and lower reflective at near-infrared wavelengths, Seen figure (9).

Table 3
NDBI Urban Differences Guide Rating for Landsat Visual 8 OLI Sensor

to	Items	Area (km2)	Percentage (%)
1	-0.42 - -0.25	53.0	5.1
2	-0.24 - -0.15	114.6	11.0
3	-0.14 - 0.01	353.5	34.1
4	0.01 - 0.24	516.9	49.8
5	0.25 - 0.61	0.0	0.0
Total		1038	100

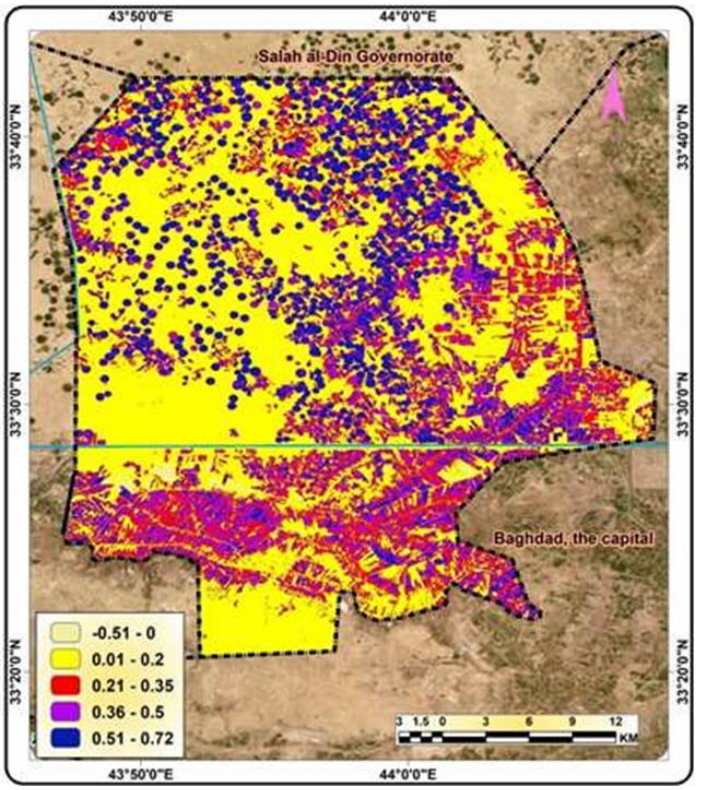
Source: ARC Map and Land Sat 8 OLI 2020

The spectral reflection of buildings and urban areas is high in near reflexive infrared (NIR) (0.76-0.90), and these wavelengths are evident within the category range (0.01-0.24), which is 516.9km^2 and 49.8% of the total area of the study area, distributed in all parts of the study area. The vine district. Which shows the distribution of buildings in a dismembered form (4) is seen in orange, and table (3). Where surface water systems are available and appear in white in shape (9) and in dark violet color on map (4). While very few appear in the nearby reflective infrared wavelength range (1.75-1.55), these wavelengths appear clearly within the range of the first three classes with negative values by directory value **(**NDBI), which is 521.1km^2 and 50.2 % of the total area of the study area, equivalent to half of the study area, is distributed in parts of the plateau areas that depend on groundwater (well water) and which appear in the gradient of color J (blue, violet, yellow) on model 4, and in the black-to-gray shape (9).

MSAVI Guide to Pursuing Growth Stages

Other MSAVI2 vegetation indicators do not work - during seed germination and leaf growth stages. Seed development threatens many risks: uneven growth, cold stress and heat stress, abnormal precipitation, elevation differences. MSAVI can be used in remote sensing to detect uneven seed growth. It can be compared with weather data on the chart that reveals the relationship between extreme weather and crop health. This knowledge in the early stages of plant development will allow farms to reset field management practices and get more yields. This guide can be obtained by formulating the following equation:

$$2\times NIR + 1 - SQRT((2\times NIR + 1)\ 2\text{-}8\times(NIR - RED))/2$$



Map 5. MSAVI Growth Control Guide rating for Landsat 8 OLI Sensor
Source: ARC Map and Land Sat 8 OLI 2020

How MSAVI interprets it in MSAVI ranges MSAVI directory values from -1 to 1, where:

- Value -1 to 0.2 refers to bare soil.
- The value represents 0.2 to 0.4 seed germination phases.
- Category 0.4 to 0.6 shows the stage of paper development (maturity).

Table 4
MSAVI Growth Monitoring Guide rating for Landsat 8 OLI Sensor

to	Items	Area (km2)	Percentage (%)
1	-0.51 - 0	8.5	0.8
2	0.01 - 0.2	549.3	53.0
3	0.21 - 0.35	189.3	18.2
4	0.36 - 0.5	141.7	13.6
5	0.51 - 0.72	149.2	14.4
Total		1038	100

Source: ARC Map and Land Sat 8 OLI 2020

The first and second figs (-0.51-0), (0.01-0.2), respectively, represent the bare soil in the vine district, with a combined area of 557.8 km^2 and 53.8% of the area of the study area, which appears on the map in blue and pistachio color seen table (4), and map. The third and fourth categories (0.21- 0.35) (0.36-0.5) represent the seed germination stages in karma district, with a combined area of 331 km2 and 31.8% of the total area of the study area, which appears on the map in yellow and brown. Either the fifth category (0.51 - 0.72) that phases the development of the plant (maturity), which covers an area of 149.2 km2 and 14.4% of the index classification areas MSAVI to monitor the growth of plants in the vine district. Seen model (5).

Assessment of the status of the classification of vegetation by classification of plant spectral evidence

The results of vegetation indicators are shown in the evidence studied above to varying degrees: NDVI, NDWI, NDBI, MSAVI) as vegetation values were effectively represented in indicators (NDVI, MSAVI) while their representation for other indicators (NDWI, NDBI) decreased and the results indicated a correlation between the values calculated for different plant guides such as (NDVI, NDBIVI) and NDBI. And an inverse relationship with indicators (NDWI, NDBI), compared to the density and condition of vegetation in the sites studied and to varying degrees, as it was found that the more dense the vegetation, the higher the values of these relationships. The impact of differences in the type of vegetation on the most important values, represented by the calculated NDVI, MSAVI, has been found that land planted with field crops appears at a high value, while degraded and degraded land has decreased in value, which is suitable for dry and semi-dry environments, due mainly to the quality of vegetation that has a direct impact on reflexivity in red and infrared wavelengths, due to the calculation of soil reflectivity in addition to soil reflection. I have vegetation when calculating MSAVI values and that's what's always made them high values.

Discussion Results

- The results of the analysis demonstrated the efficiency of digital processing of landsat-8 moon images in a study and revealed the uses of agricultural land to spend the vine.
- It is clear from the results of digital treatments that remote sensitivity data are of great importance in the study of the detection of agricultural land uses, especially in terms of the spread and density of plants and water resources through the application of the study of spectral evidence and the cleaning of modern geographical techniques.
- The study found that the use of plant spectral evidence (NDVI), (NDBI) (NDWI) (MSAVI) has a high and accurate potential in determining and monitoring the uses of agricultural land in karma district, by adopting geo information-based software, and employing a series of spectral evidence based on the automatic interpretation of space visuals using erdas 2015 .
- Through the results of the use of the NDVI guide to detect the density of vegetation by measuring the difference between nearby NIR radiation strongly reflected by plants and red visible light absorbed by plants, it was found that the areas of the plateau (Vine Island) are denser for vegetation

and are widespread in the cultivation of grain crops (wheat and barley), with an area of 124.6km^2 by 12.0% of the total study area.

- The use of the NDWI guide to detect the difference in water cover shows that the spectral reflectivity of water is high in the range of green wavelength with spectral reflection (0.60-0.52), which covers an area of 9 km^2 and0.9% of the total area of the study area, and is distributed in parts of the flood plain where surface water systems. Very few appear in the nearby infrared wavelength with spectral reflection (0.90-0.76), which is 1,029km2 and 91.0% of the total area of the study area, and is distributed in parts of the highland areas that depend on groundwater (well water) when sunlight falls on terrestrial bodies, certain wavelengths of this spectrum are absorbed and reflect other wavelengths.
- Msavi Growth Control Classification Manual is one of the most important spectral evidence for detecting the use of agricultural land, through its important conservations of land uses in karma district, which shows more than half of the area of study bare soil by 53.8%, and the area of germination of agricultural crops amounted to 31.8% of the total study area, while the areas of development of growth of agricultural crops (maturity) for 2020 represent 14.4% of the total area of study.

Recommendations

- Use satellite image space data for periodic observations and detections for the use of agricultural land, through the application of the equation of plant spectral evidence, because of its high potential in detections and knowledge of changes.
- Ways should be put in place to improve the reality of agricultural land uses in Karma district, as it is the first product of wheat crop at the level of Anbar province, because of the economic and environmental importance of the whole province of Anbar.

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